

Claims

[c1] 1. A lifting apparatus comprising:

 a frame disposable on an article to be lifted and including at least two fulcrums distributed generally symmetrically around the frame;

 at least two lifting arms each pivotally mounted to a corresponding fulcrum, each lifting arm having a lower end extending lower than the fulcrum and an upper end extending above the fulcrum; and

 a central exertion member including a top surface having one sloped portion for each lifting arm, the top surface of each sloped portion being downwardly inclined from the center of the exertion member and below the upper ends of the respective lifting arms to apply force to the upper ends of the lifting arms upon application of upward force to the exertion member.

[c2] 2. The lifting apparatus of claim 1, wherein the lower end of each lifting arm is adapted not to contact the article in a retracted position and to contact the article in an engaged position, and wherein upon application of upward force the exertion member the lifting arms rotate around the corresponding fulcrum from the retracted position to

the engaged position.

- [c3] 3. The lifting apparatus of claim 1, wherein the exertion member engages the upper ends of the lifting arms in a manner selected from the group consisting of sliding engagement and rolling engagement.
- [c4] 4. The lifting apparatus of claim 1, wherein the at least two lifting arms each comprise an approximately vertical portion outside of the frame mounted to an approximately horizontal portion extending outward from the exertion member to the upper end of the respective vertical portions.
- [c5] 5. The lifting apparatus of claim 1, further comprising first load bearing means mounted to the frame and adapted to receive lifting means.
- [c6] 6. The lifting apparatus of claim 5, wherein the first load bearing means comprises:
at least two vertical members mounted to the frame at their lower ends and on opposite sides of the frame;
a horizontal member mounted to the upper ends of the vertical members; and
a lifting eye mounted to the horizontal member.
- [c7] 7. The lifting apparatus of claim 1, wherein the horizontal portions of the at least two lifting arms each comprise a

vertical slot therethrough and further comprising vertical posts mounted to and on top of the exertion member, one vertical post mounted to each sloped portion of the exertion member and extending through and slidably disposed in a corresponding vertical slot in the horizontal portion of each lifting arm.

- [c8] 8. The lifting apparatus of claim 7, further comprising second load bearing means mounted to the vertical posts and adapted to receive lifting means.
- [c9] 9. The lifting apparatus of claim 8, wherein the second load bearing means comprises a lifting eye mounted to horizontal parts that are mounted to the upper ends of the at least two vertical posts.
- [c10] 10. The lifting apparatus of claim 7, further comprising grippers mounted to the lower end of each lifting arm and each including a gripping surface proximate to the article.
- [c11] 11. The lifting apparatus of claim 10, wherein there are at least three lifting arms, at least three vertical posts, and at least three grippers.
- [c12] 12. The lifting apparatus of claim 1, wherein the frame further comprises:
a substantially planar and horizontally oriented base in-

cluding an outside edge proximate to the article's outside edge;
vertical uprights including a lower end mounted to and distributed in spaced relation about the base; and a ring in a horizontal plane mounted to the upper end of the uprights and connecting adjacent uprights.

- [c13] 13. The lifting apparatus of claim 12, wherein the outside edge of the base is circular in the horizontal plane.
- [c14] 14. The lifting apparatus of claim 12, wherein the base comprises connected linear members.
- [c15] 15. The lifting apparatus of claim 12, wherein the outside edge of the ring is circular in the horizontal plane.
- [c16] 16. The lifting apparatus of claim 12, wherein the ring comprises connected linear members.
- [c17] 17. The lifting apparatus of claim 1, further comprising guide members mounted to the frame for aligning the frame on the article.
- [c18] 18. A lifting apparatus comprising:
a frame disposable on a cylinder to be lifted having a generally central and substantially vertical axis, the frame including:
a substantially planar and horizontally oriented base

having an outside edge proximate to the cylinder's outside edge;

vertical uprights including a lower end mounted to and distributed in spaced relation about the base;

at least two fulcrums distributed generally symmetrically around the frame and extending outward with respect to the central axis; and

a ring in a horizontal plane mounted to the upper end of the uprights and connecting adjacent uprights;

first load bearing means mounted to the frame and adapted to receive lifting means;

a lifting assembly comprising:

at least two lifting arms, distributed around the frame and each including an approximately vertical portion outside of the frame and being pivotally mounted to a corresponding fulcrum, each with a lower end that extends lower than the base, and each with an approximately horizontal portion extending radially from a central end proximate to the axis and above the ring and mounted to the upper end of the respective vertical portions, the horizontal portion having a vertical slot therethrough;

grippers mounted to the vertical portion of the lifting arms below the base, including a gripping surface proximate to the cylinder, and having a retracted position with the gripping surface not in contact with the cylinder and

an engaged position with the gripping surface in contact with the cylinder;

a central exertion member including a top surface including one sloped portion for each lifting arm, with the top surface of each sloped portion downwardly inclined from the central axis and proximate to the bottom of each lifting arm horizontal portion proximate to the central axis; and

vertical posts for lifting the lifting assembly mounted to the top of the exertion member, with one vertical post mounted to each sloped portion of the exertion member and extending through and slidably disposed in a corresponding slot in the horizontal portion of each lifting arm; and

second load bearing means mounted to the vertical posts and adapted to receive lifting means, wherein when upward force is applied to the first load bearing means, the grippers are in retracted position, and

wherein when upward force is applied to the second load bearing means, the sloped top surfaces of the exertion member apply force to the lifting arms to cause the horizontal portion central end of each lifting arm to move upward and radially outward, causing the upper end of each vertical portion to move outward, rotating each vertical portion around the fulcrum and actuating the grip-

pers to be in the engaged position.

- [c19] 19. A lifter as recited in claim 18, wherein the outside edge of the base is circular in the horizontal plane.
- [c20] 20. A lifter as recited in claim 18, wherein the base comprises connected linear members.
- [c21] 21. A lifter as recited in claim 18, wherein the outside edge of the ring is circular in the horizontal plane.
- [c22] 22. A lifter as recited in claim 18, wherein the ring comprises connected linear members.
- [c23] 23. A lifter as recited in claim 18, wherein the first load bearing means comprises:
 - at least two vertical members mounted to the frame at their lower ends and on opposite sides of the frame;
 - a horizontal member mounted to the upper ends of the vertical members; and
 - a lifting eye mounted to the horizontal member.
- [c24] 24. A lifter as recited in claim 18, wherein the second load bearing means comprises a lifting eye mounted to horizontal parts that are mounted to the upper ends of at least two vertical posts.
- [c25] 25. A lifter as recited in claim 18, further comprising guide members mounted to the frame for aligning the

frame on the cylinder.

- [c26] 26. A lifter as recited in claim 18, wherein there are at least three lifting arms, at least three vertical posts, and at least three grippers.
- [c27] 27. A method of making a lifting apparatus comprising:
 - assembling a frame disposable on an article to be lifted and including at least two fulcrums distributed generally symmetrically around the frame;
 - pivotsly mounting a lifting arm to each fulcrum, each lifting arm having a lower end extending lower than the fulcrum and an upper end extending above the fulcrum, wherein the lower end of each lifting arm is adapted not to contact the article in a retracted position and to contact the article in an engaged position;
 - providing a central exertion member including a top surface having one sloped portion for each lifting arm, the top surface of each sloped portion being downwardly inclined from the center of the exertion member and below the upper ends of the respective lifting arms to apply force to the upper ends of the lifting arms upon application of upward force to the exertion member to rotate each lifting arm around the corresponding fulcrum from the retracted position to the engaged position.
- [c28] 28. The method of claim 27, wherein each lifting arm

has an approximately vertical portion outside of the frame and an approximately horizontal portion extending outward from the exertion member and mounted to the upper end of the respective vertical portions, the horizontal portion having a vertical slot therethrough, and further comprising:

extending a vertical post through each vertical slot in the horizontal portions of the lifting arms;

mounting the vertical posts to the exertion member top surface;

mounting first load bearing means to the vertical posts;

and

mounting second load bearing means to the frame.

[c29] 29. A method of lifting an article comprising:

providing a lifting apparatus disposable on an article to be lifted, the: lifting apparatus including:

a frame including at least two fulcrums distributed generally symmetrically around the frame;

first load bearing means mounted to the frame;

at least two lifting arms each pivotally mounted to a corresponding fulcrum, each lifting arm having a lower end extending lower than the fulcrum and an upper end extending above the fulcrum, wherein the lower end of each lifting arm is adapted not to contact the article in a retracted position and to contact the article in an en-

gaged position;
a central exertion member including a top surface including one sloped portion for each lifting arm, the top surface of each sloped portion being downwardly inclined from the center of the exertion member and below the upper ends of the respective lifting arms to apply force to the upper ends of the lifting arms upon application of upward force to the exertion member; and second load bearing means mounted to the exertion member;
applying upward force to the first load bearing means to lift the lifting apparatus;
placing the lifting apparatus into position on the article;
releasing the first load bearing means;
applying upward force to the second load bearing means to cause the exertion member to apply force to the upper ends of the lifting arms to cause each lifting arm to rotate around the corresponding fulcrum from the retracted position to the engaged position; and applying increased upward force to the second load bearing means to lift the lifting apparatus and the article.